We claim:

1. A process for the preparation of N-(phosphonomethyl)glycine or a salt thereof, the process comprising contacting N-(phosphonomethyl)iminodiacetic acid or a salt thereof with an oxidation catalyst in the presence of oxygen, wherein the catalyst:

comprises a carbon support having a noble metal at a surface of the carbon support; and

is characterized as yielding no more than about 1.2 mmole of carbon monoxide per gram of catalyst when a dry sample of the catalyst in a helium atmosphere is heated from about 20 to about 900°C at a rate of about 10°C per minute, and then at about 900°C for about 30 minutes.

2. The process of claim 1 wherein the process is conducted in a continuous reactor system.

3. The process of claim 1 wherein said carbon monoxide yield is no greater than about 0.7 mmole of carbon monoxide per gram of catalyst.

4. The process of claim 1 wherein said carbon monoxide yield is no greater than about 0.5 mmole of carbon monoxide per gram of catalyst.

5. The process of claim 1 wherein said carbon monoxide yield is no greater than about 0.3 mmole of carbon monoxide per gram of catalyst.

6. The process of claim 1 wherein the oxidation is conducted in a solution or slurry, and oxygen is introduced into the solution or slurry at a rate such that at least about 40% of the oxygen is utilized.

7. The process of claim 1 wherein the oxidation is conducted in a solution or slurry, and oxygen is introduced into the solution or slurry at a rate such that at least about 60% of the oxygen is utilized.

8. The process of claim 1 wherein the oxidation is conducted in a solution or slurry, and oxygen is introduced into the solution or slurry at a rate such that at least about 80% of the oxygen is utilized.

9. The process of claim 1 wherein the oxidation is conducted in a solution or slurry, and oxygen is introduced into the solution or slurry at a rate such that at least about 90% of the oxygen is utilized.

10. The process of claim 1 wherein the oxidation is conducted in a solution or slurry, and oxygen is introduced into the solution or slurry at a rate such that at least about 40% of the oxygen is utilized until at least about 80% of the reagent has been consumed, and then introduced into the solution or slurry at a reduced rate to enhance oxidation of formaldehyde in the solution or slurry.

11. The process of claim 1 further comprising introducing a sacrificial reducing agent into the solution or slurry.

12. The process of claim 11 wherein the sacrificial reducing agent comprises formaldehyde, formic acid, or a combination thereof.

13. A process for the preparation of N-(phosphonomethyl)glycine or a salt thereof, the process

comprising contacting N-(phosphonomethyl)iminodiacetic acid or a salt thereof with an oxidation catalyst in the presence of oxygen, wherein the catalyst comprises a carbon support having a noble metal, carbon, and oxygen at a surface of the carbon support, the ratio of carbon atoms to oxygen atoms at the surface being at least about 20:1 as measured by x-ray photoelectron spectroscopy.

14. The process of claim 13 wherein the process is conducted in a continuous reactor system.

15. The process of claim 13 wherein said ratio of carbon atoms to oxygen atoms is at least about 30:1.

16. The process of claim 13 wherein said ratio of carbon atoms to oxygen atoms is at least about 40:1.

17. The process of claim 13 wherein said ratio of carbon atoms to oxygen atoms is at least about 50:1.

18. The process of claim 13 wherein said ratio of carbon atoms to oxygen atoms is at least about 60:1.

19. The process of claim 13 wherein the ratio of oxygen atoms to noble metal atoms at the surface is less than about 8:1 as measured by x-ray photoelectron spectroscopy.

20. The process of claim 19 wherein said ratio of oxygen atoms to noble metal atoms is less than about 7:1.

21. The process of claim 19 wherein said ratio of oxygen atoms to noble metal atoms is less than about 6:1.

22. The process of claim 19 wherein said ratio of oxygen atoms to noble metal atoms is less than about 5:1.

23. A process for the preparation of N-(phosphonomethyl)glycine or a salt thereof, the process comprising contacting N-(phosphonomethyl)iminodiacetic acid or a salt thereof with an oxidation catalyst in the presence of oxygen, wherein the catalyst comprises a carbon support comprising: (a) a noble metal at a surface of the carbon support; and (b) a surface layer having a thickness of about 50 Å as measured inwardly from the surface and comprising carbon and oxygen, the ratio of carbon atoms to oxygen atoms in the surface layer being at least about 20:1 as measured by x-ray photoelectron spectroscopy.

24. The process of claim 23 wherein the process is conducted in a continuous reactor system.

25. The process of claim 23 wherein said ratio of carbon atoms to oxygen atoms is at least about 30:1.

26. The process of claim 23 wherein said ratio of carbon atoms to oxygen atoms is at least about 40:1.

27. The process of claim 23 wherein said ratio of carbon atoms to oxygen atoms is at least about 50:1.

28. The process of claim 23 wherein said ratio of carbon atoms to oxygen atoms is at least about 60:1.

29. The process of claim 23 wherein the ratio of oxygen atoms to noble metal atoms in the surface layer is less than about 8:1 as measured by x-ray photoelectron spectroscopy.

30. The process of claim 29 wherein said ratio of oxygen atoms to noble metal atoms is less than about 7:1.

31. The process of claim 29 wherein said ratio of oxygen atoms to noble metal atoms is less than about 6:1.

32. The process of claim 29 wherein said ratio of oxygen atoms to noble metal atoms is less than about 5:1.

33. A process for the preparation of N-(phosphonomethyl)glycine or a salt thereof, the process comprising:

forming an oxidation catalyst by a process comprising depositing a noble metal at a surface of a carbon support, and then heating the surface at a temperature of at least about 400°C; and

contacting N-(phosphonomethyl)iminodiacetic acid or a salt thereof with the oxidation catalyst in the presence of oxygen.

34. The process of claim 33 wherein the N-(phosphonomethyl)iminodiacetic acid or a salt thereof is contacted with the oxidation catalyst in the presence of oxygen in a continuous reactor system.

35. The process of claim 33 wherein said temperature is at least about 500°C.

36. The process of claim 33 wherein said temperature is from about 550 to about 1,200°C.

37. The process of claim 33 wherein said temperature is from about 550 to about 900°C.

38. The process of claim 33 wherein, before the noble metal deposition, the carbon support has carbon and oxygen at the surface of the carbon support in amounts such that the ratio of carbon atoms to oxygen atoms at the surface is at least about 20:1 as measured by x-ray photoelectron spectroscopy.

39. The process of claim 33 wherein said heating is conducted in a non-oxidizing environment.

40. The process of claim 39 wherein said temperature is at least about 500°C.

41. The process of claim 39 wherein said temperature is from about 550 to about 1,200°C.

42. The process of claim 39 wherein the non-oxidizing environment consists essentially of at least one gas selected from the group consisting of N_2 and the noble gases.

43. The process of claim 39 wherein, before the noble metal deposition, the carbon support has carbon and oxygen at the surface of the carbon support in amounts such that the ratio of carbon atoms to oxygen atoms at the surface before the noble metal deposition is at least about 20:1 as measured by x-ray photoelectron spectroscopy.

44. The process of claim 39 wherein the non-oxidizing environment comprises a reducing environment.

45. The process of claim 44 wherein said temperature is at least about 500°C.

46. The process of claim 44 wherein said temperature is from about 550 to about 1,200°C.

47. The process of claim 44 wherein the reducing environment comprises H_2.

48. The process of claim 44 wherein, before the noble metal deposition, the carbon support has carbon and oxygen at the surface of the carbon support in amounts such that the ratio of carbon atoms to oxygen atoms at the surface before the noble metal deposition is at least about 20:1 as measured by x-ray photoelectron spectroscopy.

49. A process for the preparation of N-(phosphonomethyl)glycine or a salt thereof, the process comprising:

forming an oxidation catalyst by a process comprising: (a) depositing a noble metal at a surface of a carbon support, and (b) exposing the surface to a reducing environment; and

contacting N-(phosphonomethyl)iminodiacetic acid or a salt thereof with the oxidation catalyst in the presence of oxygen,

wherein, before the noble metal deposition, the carbon support has carbon and oxygen at the surface of the carbon support in amounts such that the ratio of carbon atoms to oxygen atoms at the surface is at least 20:1 as measured by x-ray photoelectron spectroscopy.

50. The process of claim 49 wherein the N-(phosphonomethyl)iminodiacetic acid or a salt thereof is contacted with the oxidation catalyst in the presence of oxygen in a continuous reactor system.

51. The process of claim 49 wherein the reducing environment comprises ammonia.

52. The process of claim 49 wherein the reducing environment comprises $NaBH_4$.

53. A process for the preparation of N-(phosphonomethyl)glycine or a salt thereof, the process comprising contacting, in the presence of oxygen, N-(phosphonomethyl)iminodiacetic acid or a salt thereof with a catalyst comprising a carbon support having a noble metal, a promoter, carbon, and oxygen at a surface of the carbon support.

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~~54. The process of claim 53 wherein the process is contacted in a continuous reactor system.~~

55. The process of claim 53 wherein at least 0.05% by weight of the catalyst consists of at least one promoter.

56. The process of claim 53 wherein the promoter is more easily oxidized than the noble metal.

57. The process of claim 53 wherein the promoter comprises a metal selected from the group consisting of tin, bismuth, lead, cadmium, magnesium, manganese, nickel, aluminum, cobalt, titanium, antimony, selenium, iron, rhenium, cerium, zinc, and zirconium.

58. The process of claim 53 wherein the promoter comprises tin.

59. The process of claim 53 wherein the promoter comprises iron.

60. The process of claim 53 wherein the promoter comprises titanium.

61. The process of claim 53 wherein at least two promoters are at the surface of the carbon support.

62. The process of claim 61 wherein the promoters comprise iron and tin.

63. The process of claim 53 wherein noble metal atoms at the surface are alloyed with the promoter.

64. The process of claim 53 wherein a majority of the noble metal atoms at the surface are alloyed with the promoter.

65. The process of claim 53 wherein substantially all of the noble metal atoms at the surface are alloyed with the promoter.

66. The process of claim 53 wherein the catalyst is characterized as having a ratio of carbon atoms to oxygen atoms at the surface which is at least about 20:1 as measured by x-ray photoelectron spectroscopy after the catalyst is heated at a temperature of about 500°C for about 1 hour in a hydrogen atmosphere and before the catalyst is exposed to an oxidant following the heating in the hydrogen atmosphere.

67. The process of claim 66 wherein said ratio of carbon atoms to oxygen atoms is at least about 30:1.

68. The process of claim 66 wherein said ratio of carbon atoms to oxygen atoms is at least about 40:1.

69. The process of claim 66 wherein said ratio of carbon atoms to oxygen atoms is at least about 50:1.

70. The process of claim 66 wherein said ratio of carbon atoms to oxygen atoms is at least about 60:1.

71. The process of claim 66 wherein the catalyst is further characterized as having a ratio of oxygen atoms to noble metal atoms at the surface which is less than about 8:1 after the catalyst is heated at a temperature of about 500°C for about 1 hour in a hydrogen atmosphere and before the catalyst is exposed to an oxidant following the heating in the hydrogen atmosphere.

72. The process of claim 71 wherein said ratio of oxygen atoms to noble metal atoms is less than about 7:1.

73. The process of claim 71 wherein said ratio of oxygen atoms to noble metal atoms is less than about 6:1.

74. The process of claim 71 wherein said ratio of oxygen atoms to noble metal atoms is less than about 5:1.

75. The process of claim 53 wherein the catalyst is characterized as yielding no more than about 1.2 mmole of carbon monoxide per gram of catalyst when a dry sample of the catalyst, after being heated at a temperature of about 500°C for about 1 hour in a hydrogen atmosphere and before being exposed to an oxidant following the heating in the hydrogen atmosphere, is heated in a helium atmosphere from

about 20 to about 900°C at a rate of about 10°C per minute, and then at about 900°C for about 30 minutes.

76. The process of claim 75 wherein said carbon monoxide yield is no greater than about 0.7 mmole of carbon monoxide per gram of catalyst.

77. The process of claim 75 wherein said carbon monoxide yield is no greater than about 0.5 mmole of carbon monoxide per gram of catalyst.

78. The process of claim 75 wherein said carbon monoxide yield is no greater than about 0.3 mmole of carbon monoxide per gram of catalyst.

79. A process for the preparation of N-(phosphonomethyl)glycine or a salt thereof, the process comprising contacting N-(phosphonomethyl)iminodiacetic acid or a salt thereof with an oxidation catalyst in the presence of oxygen, wherein the catalyst comprises a carbon support having: (a) a noble metal and a promoter at a surface of the carbon support; and (b) a surface layer having a thickness of about 50 Å as measured inwardly from the surface and comprising carbon and oxygen, the catalyst being characterized as having a ratio of carbon atoms to oxygen atoms in the surface layer which is at least about 20:1 as measured by x-ray photoelectron spectroscopy after the catalyst is heated at a temperature of about 500°C for about 1 hour in a hydrogen atmosphere and before the catalyst is exposed to an oxidant following the heating in the hydrogen atmosphere.

80. The process of claim 79 wherein the process is contacted in a continuous reactor system.

81. The process of claim 79 wherein said ratio of carbon atoms to oxygen atoms is at least about 30:1.

82. The process of claim 79 wherein said ratio of carbon atoms to oxygen atoms is at least about 40:1.

83. The process of claim 79 wherein said ratio of carbon atoms to oxygen atoms is at least about 50:1.

84. The process of claim 79 wherein said ratio of carbon atoms to oxygen atoms is at least about 60:1.

85. The process of claim 79 wherein the catalyst is further characterized as having a ratio of oxygen atoms to noble metal atoms in the surface layer which is less than about 8:1 after the catalyst is heated at a temperature of about 500°C for about 1 hour in a hydrogen atmosphere and before the catalyst is exposed to an oxidant following the heating in the hydrogen atmosphere.

86. The process of claim 85 wherein said ratio of oxygen atoms to noble metal atoms is less than about 7:1.

87. The process of claim 85 wherein said ratio of oxygen atoms to noble metal atoms is less than about 6:1.

88. The process of claim 85 wherein said ratio of oxygen atoms to noble metal atoms is less than about 5:1.

89. The process of claim 79 wherein at least 0.05% by weight of the catalyst consists of at least one promoter.

90. The process of claim 79 wherein the promoter is more easily oxidized than the noble metal.

91. The process of claim 79 wherein the promoter comprises a metal selected from the group consisting of tin, bismuth, lead, cadmium, magnesium, manganese, nickel, aluminum, cobalt, titanium, antimony, selenium, iron, rhenium, cerium, zinc, and zirconium.

92. The process of claim 79 wherein the promoter comprises tin.

93. The process of claim 79 wherein the promoter comprises iron.

94. The process of claim 79 wherein the promoter comprises titanium.

95. The process of claim 79 wherein at least two promoters are at the surface of the carbon support.

96. The process of claim 95 wherein the promoters comprise iron and tin.

97. The process of claim 79 wherein noble metal atoms at the surface are alloyed with the promoter.

98. The process of claim 79 wherein a majority of the noble metals at the surface are alloyed with the promoter.

99. The process of claim 79 wherein substantially all of the noble metal atoms at the surface are alloyed with the promoter.

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